CHAPTER 6

Funding Water Reuse Systems

Like the development of other utilities, the implementation of reuse facilities generally requires a substantial capital expense. Capital improvements at the wastewater treatment facility are normally required, but transmission lines can also add significantly to capital costs. In an urban setting, reuse lines must often be added to the existing transmission infrastructure, requiring careful construction processes. And unless agricultural, industrial, and recreational reuse sites are close to reclaimed water sources, these sites will require new transmission facilities as well.

In addition to the capital costs associated with reclaimed water facilities, there are also additional operation, maintenance, and replacement (OM& R) costs, including those associated with power and water quality monitoring, as well as administrative costs, such as customer billing. And, in almost all cases, implementation of a reuse system involves enhanced cross-connection programs with an associated increase in cost. These costs are typically calculated into a reclaimed water rate, expressed either as a gallonage charge or a fixed monthly fee. Even in situations where reclaimed water systems are developed in response to effluent disposal needs and customers are encouraged to make use of an "unlimited" supply at little to no charge, provisions should still be made for the day when conservation of the reclaimed water supply will be required. Another factor impacting costs is the potential drop in revenues associated with a reduction in potable water use after implementation of a reuse system. This loss of revenue can be particularly challenging if the water and wastewater systems are owned by different utilities. Consequently, multiple financial alternatives should be investigated to fund a reclaimed water system.

6.1 Decision Making Tools

To clarify the issues to be discussed, some general terms are defined as follows:

- Cost-Effectiveness – the analysis of alternatives using an effectiveness scale as a measurement concept. EPA formulated "Cost-Effectiveness Analysis Guidelines" as part of its Federal Water Pollution Control Act (40 CFR Part 35, Subpart E, Appendix A). This technique requires the establishment of a single base criterion for evaluation, such as annual water production of a specific quality expressed as an increase in supply or decrease in demand. Alternatives are ranked according to their ability to produce the same result. The alternatives can include such factors as their impact on quality of life, environmental effects, etc. which are not factored into a cost/benefit analysis.

- Cost/Benefit – the relationship between the cost of resources and the benefits expected to be realized using a discounted cash-flow technique. Non-monetary issues are not factored into these calculations.

- Financial Feasibility – the ability to finance both the capital costs and OM&R costs through locally raised funds. Examples of revenue sources include user fees, bonds, taxes, grants, and general utility operating revenues.

In the context of these definitions, the first analysis to be performed when considering a reuse system would be a cost-effectiveness analysis. This involves analyzing the relevant costs and benefits of providing additional water from fresh water sources versus reclaimed water.

Benefits that can be considered include:

- Environmental - the reduction of nutrient-rich effluent discharges to surface waters

  - the conservation of fresh water supplies
  - reduction of saltwater intrusion

- Economic - delay in or avoidance of expanding existing water supply and treatment facilities

- Delay in, or elimination of, enhancements to the existing potable water treatment systems

- Delay in, or elimination of, enhancements to the existing wastewater treatment systems

Shared benefits should also be considered. For instance, if a benefit is received by water customers from a delay in expanding the water supply (deferred rate increase), a portion of reclaimed water costs could be shared by existing and future water customers. A similar analysis can also be made for wastewater customers who benefit from a delay in, or elimination of, increased levels of treatment associated with more stringent discharge limits.

The cost/benefit analyses are conducted once feasible alternatives are selected. The emphasis of these analyses is on defining the economic impact of the project on various classes of users, (e.g., industrial, commercial, residential, agricultural). The importance of this step is that it relates the marketability of reuse relative to alternative sources, based on the end use. To elaborate, given the cost of supplying reclaimed water versus fresh water for urban use, what is the relationship of water demand to price, given both abundant and scarce resources? The present worth value of the benefits are compared to determine whether the project is economically justified and/or feasible. As part of meeting a requirement to secure a 100-year water supply, an expansion of the reuse system was found to be more cost-effective than traditional effluent disposal coupled with increasing water supplies (Gray *et al.,* 1996).

Finally, financial feasibility determines whether sufficient financial resources can be generated to construct and operate the required reclamation facilities. Specific financial resources available will be explained in subsections 6.2, 6.3, and 6.4.

6.2 Externally Generated Funding Alternatives

It is difficult to create a totally self-supporting reuse program financed solely by reclaimed water user fees. To satisfy the capital requirements for implementation of a reuse program, the majority of the construction and related capital costs are often financed through long-term water and wastewater revenue bonds, which spread the cost over multiple decades. Supplemental funds may be provided by grants, developer contributions, etc., to mitigate or offset the annual revenue requirement. The various externally generated capital funding source alternatives include:

- Local Government Tax-Exempt Bonds – The total capital cost of construction activities for a reuse project could be financed from the sale of long-term (20-30 year) bonds.

- Grants and State Revolving Fund (SRF) Programs – Capital needs could be funded partially through state or local grants programs or through SRF loans, particularly those programs designed specifically to support reuse.

- Capital Contribution – At times, there are special agreements reached with developers or industrial users, requiring the contribution of either assets or money to offset the costs of a particular project.

6.2.1 Local Government Tax-Exempt Bonds

A major source of capital financing for local governments is to assume debt – that is, to borrow money by selling municipal bonds, which enables the municipality to spread the cost of the project over many years. This approach reduces the annual amount that must be raised as compared to funding the entire capital project on a "pay-as-you-go" basis from rate revenues. With many water reclamation projects, local community support will be required to finance the project. If revenue bond financing is used, this matches the revenue stream from the use of reclaimed facilities with the costs of the debt used for construction, but does not normally require voter approval. However, voter approval may be required for general obligation bonds. The types of bonds commonly used for financing public works projects are:

- General Obligation Bonds – Repaid through collected general property taxes or service charge revenues, and generally require a referendum vote. Underlying credit support is the full faith taxation power of the issuing entity.

- Special Assessment Bonds – Repaid from the receipts of special benefit assessments to properties (and in most cases, backed by property liens if not paid by property owners). Underlying credit support is the property tax liens on the specially benefited properties.

- Revenue Bonds – Repaid through user fees and service charges derived from operating reuse facilities (useful in regional or sub-regional projects because revenues can be collected from outside the geographical limits of the borrower). Underlying credit support is the pledged revenues, such as user fees or special charges.

- Short-Term Notes – Usually repaid through general obligation or revenue bonds. These are typically used as a method of construction or interim financing until they can be incorporated into the long-term debt.

The local government must substantiate projections of the required capital outlay, of the anticipated OM&R costs, of the revenue-generating activities (i.e., the user charge system, etc.), and of the "coverage" anticipated – that is, the extent to which anticipated revenues will more than cover the anticipated capital and OM&R costs. A local government finance director, underwriter, or financial advisor can describe the requirements to justify the technical and economic feasibility of the reuse project. Since reuse facilities are often operated as part of a water and wastewater utility fund, bonds issued will probably be issued by the combined utility and thus any financial information presented will be for a combined enterprise fund. The reuse operation will most likely not have to stand alone as a self-sufficient operation and will appear financially stronger.

6.2.2 State and Federal Financial Assistance

Where available, grant programs are an attractive funding source, but require that the proposed system meets grant eligibility requirements. These programs reduce the total capital cost borne by system beneficiaries thus improving the affordability and viability of the project. Some funding agencies have an increasingly active role in facilitating water reuse projects. In addition, many funding agencies are receiving a clear legislative and executive mandate to encourage water reuse in support of water conservation.

To be financially successful over time, a reuse program, however, must be able to "pay for itself." While grant funds may underwrite portions of the capital improvements necessary in a reuse project – and in a few states, state-supported subsidies can also help a program to establish itself in early years of operation – grant funds should not be expanded for funding needs associated with annual operating costs. In fact, most federally- funded grant and loan programs explicitly prohibit the funding of OM&R costs. Once the project is underway, the program should strive to achieve self-sufficiency as quickly as possible – meeting OM&R costs and debt service requirements of the local share of capital costs by generating an adequate stream of revenues through local sources.

6.2.2.1 State Revolving Fund

The SRF is a financial assistance program established and managed by the states under general EPA guidance and regulations and funded jointly by the federal government (80 percent) and state matching money (20 percent). It is designed to provide financial assistance to local agencies to construct water pollution control facilities and to implement non-point source, groundwater, and estuary management activities, as well as potable water facilities.

Under SRF, states make low-interest loans to local agencies. Interest rates are set by the states and must be below current market rates and may be as low as 0 percent. The amount of such loans may be up to 100 percent of the cost of eligible facilities. Loan repayments must begin within 1 year after completion of the facility and must be completely amortized in 20 years. Repayments are deposited back into the SRF to be loaned to other agencies. The cash balance in the SRF may be invested to earn interest, which must accrue to the SRF.

States may establish eligibility criteria within the broad limits of the Clean Water State Revolving Fund (CWSRF). Basic eligible facilities include secondary and advanced treatment plants, pump stations, and force mains needed to achieve and maintain NPDES permit limits. States may also allow for eligible collection sewers, combined sewer overflow correction, stormwater facilities, and the purchase of land that is a functional part of the treatment process.

Water conservation and reuse projects eligible under the Drinking Water State Revolving Fund (DWSRF) include installation of meters, installation or retrofit of water efficient devices such as plumbing fixtures and appliances, implementation of incentive programs to conserve water (e.g., rebates, tax breaks, vouchers, conservation rate structures), and installation of dual-pipe distribution systems as a means of lowering costs of treating water to potable standards.

In addition to providing loans to water systems for water conservation and reuse, states can use their DWSRF set-aside funds to promote water efficiency through activities such as: development of water conservation plans, technical assistance to systems on how to conserve water (e.g., water audits, leak detection, rate structure consultation), development and implementation of ordinances or regulations to conserve water, drought monitoring, and development and implementation of incentive programs or public education programs on conservation.

States select projects for funding based on a priority system, which is developed annually and must be subjected to public review. Such priority systems are typically structured to achieve the policy goals of the state and may range from "readiness to proceed" to very specific water quality or geographic area objectives. Each state was allowed to write its own program regulations for SRF funding, driven by its own objectives. Some states, such as Virginia, provide assistance based on assessing the community's economic health, with poorer areas being more heavily subsidized with lower interest loans.

Further information on the SRF program is available from each state's water pollution control agency.

6.2.2.2 Federal Policy

The Clean Water Act of 1977, as amended, supports water reuse projects through the following provisions:

- Section 201 of PL 92-500 was amended to ensure that municipalities are eligible for "201" funding only if they have "fully studied and evaluated" techniques for "reclaiming and reuse of water." A 201 facility plan study must be completed to qualify for state revolving loan funds.

- Section 214 stipulates that the EPA administrator "shall develop and operate a continuing program of public information and education on water reclamation and reuse of wastewater. . ."

- Section 313, which describes pollution control activities at federal facilities, was amended to ensure that wastewater treatment facilities will utilize "recycle and reuse techniques: if estimated life-cycle costs for such techniques are within 15 percent of the most cost-effective alternative."

6.2.2.3 Other Federal Sources

There are a number of federal sources that might be used to generate funds for a water reuse project. While there are many funding sources, only certain types of applicants or projects are eligible for assistance under each program.

The U.S. Department of Agriculture (USDA) has several programs that may provide financial assistance for water reuse projects in rural areas, but the definition of a rural area varies depending upon the statutory language authorizing the program. Most of these programs are administered through the USDA Rural Development Office in each state.

Rural Utilities Service (RUS) offers funds through the Water and Waste Program, in the form of loans, grants, and loan guarantees. The largest is the Water and Waste Loan and Grant Program, with approximately $1.5 billion available nationwide per year. This program offers financial assistance to public bodies, eligible not-for-profits and recognized tribal entities for development (including construction and non-construction costs) of water and wastewater infrastructure. Unincorporated areas are typically eligible, as are communities with less than 10,000 people. Grants may be available to communities meeting income limits to bring user rates down to a level that is reasonable for the serviced population. Interest rates for loan assistance depend on income levels in the served areas as well. The Rural Development offices act to oversee the RUS-funded projects from initial application until the operational stage.

Other Rural Development programs are offered by the Rural Housing Service and the Rural Business-Cooperative Service. Rural Housing Service offers the Community Facilities Program that may fund a variety of projects for public bodies, eligible not-for-profits, and recognized tribal entities where the project serves the community. This includes utility projects and may potentially include a water reuse project, if proper justification is provided. The Rural Business-Cooperative Service offers the Rural Business Enterprise Grant program to assist grantees in designing and constructing public works projects. A water reuse system serving a business or industrial park could potentially receive grant assistance through this program. An individual eligible business could apply for loan guarantees through the Rural Business-Cooperative Service to help finance a water reuse system that would support the creation of jobs in a rural area.

Other agencies that have funded projects in cooperation with USDA may provide assistance for water reuse projects if eligibility requirements are met include the Economic Development Administration, Housing and Urban Development (Community Development Block Grant), Appalachian Regional Commission, and the Delta Regional Commission.

Finally, the Bureau of Reclamation, authorized under Title XVI, the Reclamation Wastewater and Groundwater Study and Facilities Act; PL 102-575, as amended, Reclamation Recycling and Water Conservation Act of 1996; PL 104-266, Oregon Public Lands Transfer and Protection Act of 1998; PL 105-321, and the Hawaii

Water Resources Act of 2000; PL 106-566, provides for the Bureau to conduct appraisal and feasibility studies on water reclamation and reuse projects. The Bureau can then fund construction of reuse projects after Congressional approval of the appropriation. This funding source is restricted to activities in the 17 western states unless otherwise authorized by Congress. Federal participation is generally up to 25 percent of the capital cost.

Information about specific funding sources can be found in the *Catalog of Federal and Domestic Assistance,* prepared by the Federal Office of Management and Budget and available in federal depository libraries. It is the most comprehensive compilation of the types and sources of funding available.

6.2.2.4 State, Regional, and Local Grant and Loan Support

State support is generally available for wastewater treatment facilities, water reclamation facilities, conveyance facilities, and, under certain conditions, for on-site distribution systems. A prime source of state-supported funding is provided through SRF loans.

Although the number of states that have developed other financial assistance programs that could be used for reuse projects is still limited, there are a few examples. Texas has developed a financial assistance program that includes the Agriculture Water Conservation Grants and Loans Program, the Water Research Grant Program, and the Rural Water Assistance Fund Program. There is also a planning grant program – Regional Facility Planning Grant Program and Regional Water Planning Group Grants – that funds studies and planning activities to evaluate and determine the most feasible alternatives to meet regional water supply and wastewater facility needs.

Local or regional agencies, such as the regional water management districts in Florida, have taxing authority. In Florida, a portion of the taxes collected has been allocated to the funding of alternative water sources including reuse projects, which have been given a high priority, with as much as 50 percent of a project's transmission system eligible for grant funding. Various methods of prioritization exist, with emphasis on those projects that are of benefit to multi-jurisdictional users.

The State of Washington began its process of addressing water reclamation and reuse issues by passing the Reclaimed Water Act of 1992. In 1997, the State Legislature provided $10 million from the Centennial Clean Water Fund to help fund 5 demonstration projects. These projects have been completed and are currently providing reclaimed water for a variety of non-potable uses.

A comprehensive water reuse study in California concluded that funding was the primary constraint in implementing new water reuse projects (California State Water Resources Control Board, 1991).

To assist with the financial burden, grant funds are now available from the California Department of Water Resources for water conservation and groundwater management. Proposition 13 Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Bond Act provides funds for:

- Agriculture water conservation capital outlay
- Groundwater recharge construction loans
- Groundwater storage construction grants
- Infrastructure rehabilitation feasibility study grants
- Infrastructure rehabilitation construction grants
- Urban streams restoration program grants
- Urban water conservation capital outlay grants

AB303, the Local Groundwater Management Assistance Act of 2000, also provides grants. Funds have been used by Daly City, California to develop a groundwater-monitoring program and to refine models of the Westside Basin aquifer.

The passage of California's Proposition 50 in November 2002 makes funds available for projects to "protect urban communities from drought, increase supplies of clean drinking water, reduce dependence on imported water, reduce pollution of rivers, lakes, streams, and coastal waters, and provide habitat for fish and wildlife." This includes financing for "groundwater recharge and management projects." The State Water Resources Control Board (SWRCB) and the U.S. Bureau of Reclamation have played major roles in providing capital funding for local projects.

6.2.3 Capital Contributions

In certain circumstances, where reclaimed water is to be used for a specific purpose, such as cooling water, it may be possible to obtain the capital financing for new transmission facilities directly from one or more major users that benefit from the available reclaimed water supply.

One example of such a capital contribution would be construction of a major reuse transmission line by a developer who then transfers ownership to the utility for operation and maintenance. Another example is a residential housing developer, golf course, or industrial user who may provide the pipeline, financing for the pipeline, or provide for a pro-rata share of construction costs for a specific pipeline. In the event the private entity initially bears the entire capital cost of the improvement, such an approach may include provisions for reimbursement to the entity from future connections to the contributed facility for a specified period of time.

6.3 Internally Generated Funding Alternatives

While the preceding financing alternatives describe the means of generating construction capital, there is also a need to provide funding for OM&R costs, as well as debt service on borrowed funds. Examples of various internally-generated funding sources are highlighted, with details, in the following subsections.

In most cases, a combination of several funding sources will be used to recover capital and OM&R costs. The following alternatives may exist for funding water reuse programs.

- Reclaimed water user charges
- Operating budget and cash reserves of the utility
- Local property taxes and existing water and wastewater user charges
- Public utility tax
- Special assessments or special tax districts
- Connection fees

The City of Reno, Nevada, used a combination of special assessment districts bonds, revenue bonds, developer agreements, connection fee charges, user fees, and general fund advances as part of the creation of its reclaimed water system (Collins, 2000).

6.3.1 Reclaimed Water User Charges

The first source of funding considered should be a charge to those receiving reclaimed water services. As noted in the introduction, reclaimed water systems may well begin life as effluent disposal programs. Under such circumstances, reclaimed water "customers" are likely to be encouraged to use as much water as they want. A negligible fee may have been adopted to support the "all you can use" mentality. Very often a fixed rate will be used to simplify billing and eliminate penalties for overuse in the form of increased costs. While such an approach may seem to be justified when a project begins, this rationale for basing user fees falls by the wayside as water resources become stressed and reclaimed water supplies become a valuable resource. User charges would be utilized to generate a stream of revenues with which to defray the OM&R costs of the reuse facility and the debt service of any bonds or loans issued.

In a reclaimed water user charge system, the intent of an equitable rate policy is to allocate the cost of providing reuse services to the recipient. With a user charge system, it is implicit that there be select and identifiable user categories to which the costs of treatment and distribution can be allocated.

There are 2 prime means of allocating costs that are to be incorporated into a user charge: the proportionate share cost basis and the incremental cost basis. These 2 methods are discussed in more detail in Section 6.4.

Determining an equitable rate policy requires consideration of the different service needs of individual residential users (single-family and multi-family) as compared to other "larger" users with bigger irrigable areas, such as golf courses and green spaces. In many cases, a lower user rate can be justified for such large users than for residential customers. As an example, large users may receive reclaimed water into on-site storage facilities and then subsequently repump the water into the irrigation system, enabling the supplier to deliver the reclaimed water, independent of daily peak demands, using low-pressure pumps rather than providing high-pressure delivery on demand as required by residential users. Some multi-family customers may be treated as "large" users under this example, unless the reclaimed water is delivered at high pressure directly into the irrigation system. This flexibility in delivery and the low-pressure requirements can often justify the lower rate. At the same time, keeping reclaimed water rates competitive for large users when considering alternative sources of water, such as groundwater, is another consideration.

The degree of income from other sources, such as the general fund and other utility funds, must be considered in determining the balance of funding that must come from reuse rates. Residential user fees must be set to make water reuse an attractive option to potable water or groundwater. Alternatively, local regulations can prescribe that reclaimed water must be used for irrigation and other outdoor nonpotable uses in areas where it is available so usage becomes less sensitive to pricing. Although reclaimed water may have to be priced below potable water to encourage its use, reuse rates may also be set to discourage indiscriminate use by instituting volume (per gallon) charges rather than a flat fee; however, as reclaimed water has become recognized as an increasingly valuable element of an overall water resources plan, the trend is to meter reuse consumption to better monitor and control its use.

6.3.2 Operating Budget and Cash Reserves

Activities associated with the planning and possible preliminary design of reuse facilities could be funded out of an existing wastewater utility/department operating budget. A water supply agency seeking to expand its water resources would find it appropriate to apply a portion of its operating funds in a similar way. It could be appropriate, for example, to utilize funds from the operating budget for planning activities or business costs associated with assessing the reuse opportunity. Furthermore, if cash reserves are accruing for unspecified future capital projects, those funds could be used for design and construction costs, or a portion of the operating revenues from utility revenues can be set aside in a cash reserve for future needs.

The obvious advantage of using this alternative source of funding is that the utility board or governing body of the water and/or wastewater department or utility can act on its own initiative to allocate the necessary resources. These sources are especially practical when relatively limited expenditures are anticipated to implement or initiate the reuse program, or when the reuse project will provide a general benefit to the entire community (as represented by the present customers of the utility). In addition, utilizing such resources is practical when the reclaimed water will be distributed at little or no cost to the users, and therefore, will generate no future stream of revenues to repay the cost of the project. While it is ideal to fully recover all direct costs of each utility service from customers, it may not be practical during the early phases of a reuse system implementation.

6.3.3 Property Taxes and Existing User Charges

If the resources available in the operating budget or the cash reserves of the utility are not sufficient to cover the necessary system, OM&R activities, and capital financing debt, then another funding source to consider is revenues generated by increasing existing levies or charges. If some utility costs are currently funded with property taxes, levies could be increased and the new revenues designated for expenses associated with the reuse project. Similarly, the user charge currently paid for water and wastewater services could be increased. Like using the operating budget or cash reserves, the use of property taxes or user charges may be desirable if the expenditures for the project are not anticipated to be sizable or if a general benefit accrues to the entire community.

Ad valorem property taxes, unlike user charges, raise funds on the basis of assessed value of all taxable property, including residential, commercial, and industrial. Property value can be an appropriate means of allocating the costs of the service improvements if there is a "general good" to the community. It is also a useful means of allocating the cost of debt service for a project in which there is general good to the community and in which the specific OM&R costs are allocated to the direct beneficiaries. A contribution of *ad valorem* property tax revenues might be appropriate for such reuse applications as:

- Irrigation of municipal landscaping
- Fire protection
- Water for flushing sewers
- Groundwater recharge for saltwater intrusion barriers
- Parks and recreational facility irrigation

All such projects have benefits, either to the residents of the municipality in general, or to those who can be isolated in an identifiable special district.

Resources generated by increasing any existing user charges can be used in a similar manner. However, to do so equitably, benefits of the proposed project should primarily accrue to those presently utilizing the services of the water or wastewater utility. This would be the case, for example, when water reuse precludes the need to develop costly advanced treatment facilities or a new water supply source.

Contributions from the water and wastewater systems may be warranted whenever there is a reduction in the average day or peak day water demand or when the reuse system serves as a means of effluent disposal for the wastewater system. The City of St. Petersburg, Florida, for example, provides as much as 50 percent of the urban reuse system operations costs from water and wastewater system funds. The significant reduction in potable water demand achieved through water reuse has allowed the City to postpone expansion of its water treatment plant.

6.3.4 Public Utility Tax

The State of Washington took a rather innovative approach to funding when it passed a major water bill in 2001. The new law addresses several key areas in water resource management, including an incentive program to promote conservation and distribution of reclaimed water. The Public Utility Tax (Chapter 82.16 Revised Code of Washington) is levied on gross income of publicly and privately-owned utilities. The incentive program (Chapter 237), which exempts 75 percent of the amounts received for reclaimed water services for commercial and industrial uses, also allows reclaimed water utilities to deduct from gross income 75 percent of amounts expended to improve consumer water use efficiency or to otherwise reduce the use of water by the consumer. (Focus, Washington State Department of Ecology, August 2001) Examples of eligible measures are:

- Measures that encourage the use of reclaimed water in lieu of drinking water for landscape or crop irrigation

- Measures that encourage the use of moisture sensors, flow timers, low-volume sprinklers, or drip irrigation for efficiencies in reclaimed water use

Many variations on this incentive theme could be adopted by states, such as imposing a utility tax directly on large water users and granting exemptions for reclaimed water use.

6.3.5 Special Assessments or Special Tax Districts

When a reuse program is designed to be a self-supporting enterprise system, independent of both the existing water and wastewater utility systems, it may be appropriate to develop a special tax or assessment district to recover capital costs directly from the benefited properties. The advantage of this cost recovery mechanism is that it can be tailored to collect the costs appropriate to the benefits received. The City of Cape Coral, Florida, is one example of an area using special assessments to fund dual-water piping capital costs for fire protection and irrigation water. This special assessment was levied at an approximate cost of $1,600 per single-family residence with financing over 8 years at 8 percent annual interest. In addition, a monthly user charge is also applied to the water and wastewater billing to assist in defraying operating costs.

Special assessments may be based on lot front footage, lot square footage, or estimated gallon use relative to specific customer types. This revenue alternative is especially relevant if the existing debt for water and wastewater precludes the ability to support a reuse program, or if the area to be served is an independent service area with no jurisdictional control over the water or wastewater systems. The implementation of reclaimed water systems will reduce potable water consumption, corresponding to a reduction of revenues. This must be factored into the funding analysis.

6.3.6 Impact Fees

Impact fees, or capacity fees, are a means of collecting the costs of constructing an infrastructure element, such as water, wastewater, or reuse facilities, from those new customers benefiting from the service. Impact fees collected may be used to generate construction capital or to repay borrowed funds. Frequently, these fees are used to generate an equitable basis for cost recovery between customers connecting to the system in the early years of a program and those connecting in the later years. The carrying costs (interest expenses) are generally not fully recovered through the impact fee, although annual increases above a base cost do provide equity between groups connecting in the early years and those in later years.

Impact fees for water reuse systems are implemented at the discretion of the governing body. However, requiring a fee to be paid upon applying for service prior to construction can provide a strong indication of public willingness to participate in the reuse program. Incentive programs can be implemented in conjunction with impact fees by waiving the fee for those users who make an early commitment to connect to the reclaimed water system (e.g., for the first 90 days after construction completion) and collecting the fee from later connections.

6.4 Incremental Versus Proportionate Share Costs

6.4.1 Incremental Cost Basis

The incremental cost basis allocates only the marginal costs of providing service to the customer. This system can be used if the community feels that the marginal reclaimed water user is performing a social good by conserving potable water, and should be allocated only the additional increment of cost of the service. However, if the total cost savings realized by reuse are being enjoyed only by the marginal user, then in effect, the rest of the community is subsidizing the service. For example, an ocean outfall used as the primary means of effluent disposal could be tapped and reclaimed water mains extended to provide irrigation to one or more developments in an area that formerly used potable water. In this example, it may be appropriate to charge the developments only for the cost of installing the additional mains plus any additional treatment that might be required.

6.4.2 Proportionate Share Cost Basis

Under the commonly used proportionate share basis, the total costs of the facilities are shared by the parties in proportion to their usage. In apportioning the costs, consideration must be given to the quantity and quality of the water, the reserve capacity that must be maintained, and the use of any joint facilities, particularly means of conveyance. In determining the eventual cost of reuse to the customer base, the apportionment of costs among wastewater users, potable water users, and reclaimed water users must be examined. The allocation of costs among users also must consider the willingness of the local community to subsidize a reuse program.

A proportional allocation of costs can be reflected in the following equations:

Total wastewater service = wastewater treatment to permitted disposal standards + effluent disposal + transmission + collection

Total potable water service = water treatment + water supply + transmission + distribution

Total reclaimed water service = [reclaimed water treatment – treatment to permitted disposal standards] + additional transmission + additional distribution + additional storage

These equations illustrate an example of distributing the full costs of each service to the appropriate system and users. The first equation distributes only the cost of treating wastewater to currently required disposal standards, with any additional costs for higher levels of treatment, such as filtration, coagulation, or disinfection, assigned to the cost of reclaimed water service. In the event that the cost of wastewater treatment is lowered by the reuse alternative because current effluent disposal standards are more stringent than those required for the reuse system, the credit accrues to the total cost of reclaimed water service. This could occur, for example, if treatment for nutrient removal had been required for a surface water discharge but would not be necessary for agricultural reuse.

As previously noted, because reclaimed water is a different product from potable water and has restrictions on its use, it may be considered a separate, lower valued class of water and priced below potable water. Thus, it may be important that the user charges for reuse be below, or at least competitive with, those for potable water service. However, often the current costs of constructing reuse facilities cannot compete with the historical costs of an existing potable water system. One means of creating a more equitable basis for comparison is to associate new costs of potable water supplies to the current costs of potable water, as well as any more costly treatment methods or changes in water treatment requirements that may be required to meet current regulations. When creating reuse user fees, it may be desirable to deduct incremental potable water costs from those charged for reuse because reuse is allowing the deferral or elimination of developing new potable water supplies or treatment facilities. The perceived inequalities between reclaimed water and potable water may be eliminated where potable water is in short supply and subject to seasonal (or permanent) restrictions. For customers that cannot tolerate uncertainty in deliveries, a source of reclaimed water free from restrictions might be worth more than traditional supplies.

To promote certain objectives, local communities may want to alter the manner of cost distribution. For example, to encourage reuse for pollution abatement purposes by eliminating a surface water discharge, the capital costs of all wastewater treatment, reclaimed water transmission, and reclaimed water distribution can be allocated to the wastewater service costs. To promote water conservation, elements of the incremental costs of potable water may be subtracted from the reuse costs to encourage use of reclaimed water.

For water reuse systems, the proportionate share basis of allocation may be most appropriate. The allocation should not be especially difficult, because the facilities required to support the reuse system should be readily identifiable. As shown in the previous equations, it is appropriate to allocate to wastewater charges the costs of all treatment required for compliance with NPDES permits. All additional costs, including the costs of reclamation and conveyance of reclaimed water, would be allocated to the water reuse user charge.

General and administrative costs should also be allocated proportionately to all services just as they would be in a cost-of-service allocation plan for water and wastewater service. In some cases, lower wastewater treatment costs may result from initiating reclaimed water usage. Therefore, the result may be a reduction in the wastewater user charge. In this case, depending on local circumstances, the savings could be allocated to either the wastewater customer or the reclaimed water customer, or both.

Table 6-1 provides a range of credits that can be applied to the financial analysis of water reclamation projects based on experience in California (Sheikh *et al.,* 1998).

With more than one category or type of reclaimed water user, different qualities of reclaimed water may be needed. If so, the user charge becomes somewhat more complicated to calculate, but it is really no different than calculating the charges for treating different qualities of wastewater for discharge. If, for example, reclaimed water is distributed for 2 different irrigation needs with one requiring higher quality water than the other, then the user fee calculation can be based on the cost of treatment to reach the quality required. This assumes that it is cost-effective to provide separate delivery systems to customers requiring different water quality. Clearly this will not always be the case, and a cost/benefit analysis of treating the entire reclaimed water stream to the highest level required must be compared to the cost of separate transmission systems. Consideration should also be given to providing a lower level of treatment to a single reclaimed water transmission system with additional treatment provided at the point of use as required by the customer.

Estimating the operating cost of a reclaimed water system involves determining those treatment and distribution components that are directly attributable to the reclaimed water system. Direct operating costs involve additional treatment facilities, distribution, additional water quality monitoring, and inspection and monitoring staff. Any costs saved from effluent disposal may be considered a credit. Indirect costs include a percentage of administration, management, and overhead. Another cost is replacement reserve, i.e., the reserve fund to pay for system replacement in the future. In many instances, monies generated to meet debt service coverage requirements are deposited into replacement reserves.

6.5 Phasing and Participation Incentives

The financing program can be structured to construct the water reuse facilities in phases, with a target percentage of the potential customers committed to using reclaimed water prior to implementation of each phase. This commitment assures the municipal utility decision makers that the project is indeed desired and ensures the financial stability to begin implementation. Incentives, such as a reduction or waiver of the assessment or connection fee for those connections to the system within a set time frame, can be used to promote early connections or participation. The San Antonio, Texas, reclaimed water system charges for reclaimed water will be $280/acre-foot ($0.86/1,000 gallons), the same as the cost of potable water. As an incentive for users to sign up for this service, the city offered a one-time $900/acre-foot ($2.76/1,000 gallons) credit to cover the user's costs of converting to reclaimed water (Martinez, 2000).

Adequate participation to support implementation can be determined by conducting an initial survey in a service area, followed by a formal voted service agreement for each neighborhood. If the required percentage of residents in a given neighborhood agree to participate, facilities will be constructed in that area. Once this type of measure is taken, there is an underlying basis for either assessing pipeline costs, or charging using a monthly fixed fee, because the ability to serve exists. The rate policy may also include a provision for assessments or charges for undeveloped properties within a neighborhood served by a reclaimed water system.

Table 6-1. Credits to Reclaimed Water Costs

Benefit	Applicability	Value ($/acre-feet)
Water supply	Very common	$300 - $1,100
Water supply reliability	Very common	$100 - $140
Effluent disposal	Very common	$200 - $2,000
Downstream watershed	Common	$400 - $800
Energy conservation	Situational	0 to $240

6.6 Sample Rates and Fees

6.6.1 Connection Fees

Connection charges to a dual distribution system are often based on the size of the reclaimed water system being served. For example, in Cocoa Beach, Florida, customers are charged a connection fee based on the size of the reclaimed water service line. The connection fees are $100, $180, and $360 for a 3/4-inch, 1-inch, and 1-1/2-inch service line, respectively.

As an alternative to connection fees, a flat monthly rate can be charged to each user for a specified length of time until the capital costs associated with the system are paid off. This alternative is often preferred to spread out the costs associated with connection fees.

6.6.2 User Fees

The procedure for establishing rates for reclaimed water can be similar to the procedure for establishing potable water and wastewater rates. If reclaimed water is metered, then user rates can be based upon the amount of reclaimed water used. This will tend to temper excessive use. If meters are not used, then a flat rate can be charged. **Table 6-2** presents user fees for a number of existing urban reuse systems.

It is common for the cost of reclaimed water service to be based on a percentage of the cost of potable water service. One might assume that reclaimed water rates would always be less than that of potable water but this may not be the case. A recent survey of reclaimed water utilities in California (**Table 6-3**) shows the range of discounts for reclaimed water (Lindow and Newby, 1998). This survey clearly shows that reclaimed water can command rates equal to that of potable water depending on the specific nature of local water resources.

Table 6-3. Discounts for Reclaimed Water Use in California

Jurisdiction	Cost Percentage of Potable Water (%)
City of Long Beach	53
Marin Municipal Water District	56
City of Milpitas	80
Orange County Water District	80
San Jose Water Company	85
Irvine Ranch Water District	90
Carlsbad Municipal Water District	100
East Bay Municipal Utility District	100
Otay Water District	100

Figure 6-1 provides the results of a similar survey of potable and reclaimed water rates for utilities in southwest Florida (Personal Communication with Dennis Cafaro, 2003). With the exception of Barron Collier utilities, reclaimed water rates tend to be less than 50 percent of the potable water rates, with some rates for reuse less than 20 percent that of potable water. These results provide additional evidence that reclaimed water rates are highly dependent on local conditions.

To further reinforce the concept that reclaimed water is a valuable resource, utilities may consider not only charging for reclaimed water by the gallon, but also implementing a conservation rate structure to encourage efficient use. Conservation rate structures provide economic incentives for consumers to limit water use. To the extent possible, they should achieve similar results in all customer classes, be equitable within and among customer classes, support the utility's financial requirements, and can be revenue neutral. Structures can significantly reduce water use without government expenditure or new regulation, while helping to protect both the quantity and quality of water resources. For example, at system start-up some residential customers in the City of Venice, Florida were charged a flat rate for reclaimed water service. When the rate structure was changed to charge customers for the actual volume of water used, including an inclining conservation rate, demand was reduced by 10 to 15 percent. However, no change in the peak demand water use was observed – suggesting peak use was driven by actual need and reductions were the result of more efficient water use in low demand periods (Farabee *et al.,* 2002).

6.7 Case Studies

6.7.1 Unique Funding Aspects of the Town of Longboat Key, Florida Reclaimed Water System

Longboat Key is a barrier island community located on Florida's Gulf coast. The town lies within 2 counties—the northern portion of Longboat Key is in Manatee County and the southern portion is in Sarasota County. The island is surrounded by the Gulf of Mexico on the west and Sarasota Bay on the east. The town's geographical location severely limits local water resources. Since its inception in 1972, the Town of Longboat Key has received potable water and wastewater services from Manatee County.

Landscape irrigation accounts for approximately a quarter of the town's potable water use. In 2002, it was necessary for the town to seek an alternative water source for irrigation since its current potable water use exceeded what is available through Manatee County agreement al-

Table 6-2. User Fees for Existing Urban Reuse Systems

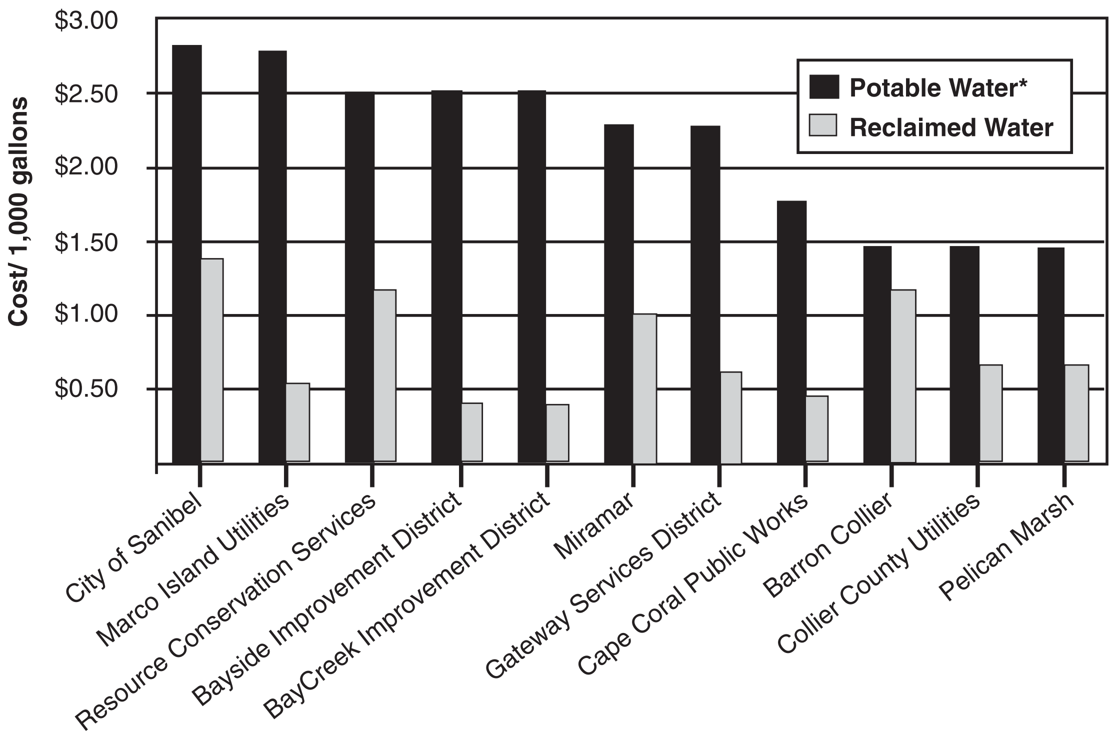
Location	User Fee
Amarillo, Texas[1]	$0.15/1,000 gallons
Cocoa Beach, Florida[1]	Residential (not metered): ▪ $8/month/acre Commercial (metered): ▪ $0.26/1,000 gallons
Colorado Springs, Colorado[1]	$0.00685/cubic foot ($0.91/1,000 gallons)
County of Maui, Hawaii[1]	Major agriculture: ▪ $0.10/1,000 gallons Agriculture, golf course: ▪ $0.20/1,00 gallons Other: ▪ $0.55/1,000 gallons
Henderson, Nevada[1]	$0.71/1,000 gallons
San Rafael, California[1]	Tier 1: $2.02/CCF for 0-100% of water budget Tier 2: $3.89/CCF for 100-150% of water budget Tier 3: $7.64/CCF for over 150% of water budget
South Bay, California[1]	Inside service area: ▪ $280/AF ($0.86/1,000 gallons) for 0-25 AF/month ▪ $260/AF ($0.80/1,000 gallons) for 25-50 AF/month ▪ $240/AF ($0.74/1,000 gallons) for 50-100 AF/month ▪ $220/AF ($0.68/1,000 gallons) for 100-200 AF/month ▪ $200/AF ($0.61/1,000 gallons) for 200+ AF/month
St. Petersburg, Florida[1]	Residential (not metered): ▪ $10.36/month for first acre + $5.92/month for each additional acre
Wheaton, Illinois[1]	$0.18/1,000 gallons
Summary of Florida Reuse Systems[2]	Residential - Flat Rate ($/month) ▪ Average = $13.81 ▪ Range = $0.00 - $350.00[3] Residential - Gallonage Charge ($/1,000 gallons) ▪ Average = $0.32 ▪ Range = $0.00 - $1.25 Non-Residential - Flat Rate ($/month) ▪ Average = $445.35 ▪ Range = $0.00 - $12,595.00 Non-Residential Gallonage Charge ($/1,000 gallons) ▪ Average = $0.26 ▪ Range = $0.00 - $2.50

[1] User fees as reported in management practices for nonpotable water reuse, Project 97-IRM-6, Water Environment Research Foundation, 2001.

[2] Reuse Rates as reported in the Florida Department of Environmental Protection, Reuse Inventory Report, June 2002.

[3] Includes lump sum rates charged to residential developments as well as individual residential customers.

Figure 6-1. Comparison of Reclaimed Water and Potable Water Rates in Southwest Florida



*Base rate cost of potable water
(Many utilities use an inclining rate structure for potable water.)

locations. Historically, the town has also used groundwater to meet approximately 80 percent of its irrigation demands. However, a decline in groundwater quality attributed to saltwater intrusion caused by long-term withdrawals and probable overpumping has been observed.

After the review and evaluation of many alternatives, the Town of Longboat Key opted for a reclaimed water system with supply provided by an adjoining jurisdiction, the City of Sarasota, Florida. The project will require:

- Installation of a subaqueous reclaimed water transmission main across Sarasota Bay
- Construction of aquifer storage and recovery facilities
- Construction of delivery pumping stations
- Construction of a 2.5-million-gallon (9,460-m^3) storage tank
- Construction of associated distribution mains

The Longboat Key reclaimed water transmission system will connect to the City of Sarasota's existing reclaimed water system. Two and a half million gallons per day of reclaimed water will be available from the City of Sarasota. The conceptual planning cost for the project is estimated to be $28,166,000.

The reclaimed water rate structure has been designed so the system can be financially self-sufficient. The end user costs are the true cost of providing the service. The estimated cost per 1,000 gallons will be approximately $2.67. By obtaining funding through the SRF loan program, the town will be able to satisfy the capital requirements for system implementation. Since loan repayments are not required to begin until 1 year after completion of the facility, semi-annual debt service payments and OM&R costs will be satisfied from the operating revenues of the reclaimed water system.

Water and wastewater revenues are not intended to be used to pay for the reclaimed water system, but instead will serve as a backup pledge to the pledge of reclaimed water revenues for the SRF loan. To the extent that water and wastewater revenues are used to make any semi-annual loan payments, the town intends to reimburse its water and wastewater revenues fund with reclaimed water revenues.

The reclaimed water revenue source is contingent on commitments in the form of user agreements from condominium and homeowner's associations. The public has voted for a town-required referendum authorizing the financing of a reclaimed water system.

6.7.2 Financial Assistance in San Diego County, California

Water reclamation is an important component of the San Diego region's local water resources. A number of agencies in San Diego continue to implement and expand their water reuse projects. Currently, about 12,000 acre-feet (3.9 billion gallons) per year of reclaimed water is beneficially reused within the service area of Water Authoriy Board of the County of San Diego (Authority). Approximately 64 percent of the water is used for agriculture, landscape irrigation, and other municipal and industrial uses; the remaining 36 percent is recharged into groundwater basins. This number is projected to increase to over 53,000 acre-feet per year (17.3 billion gallons per year) by 2020.

Financial assistance programs play a critical role in the development of reclaimed water supplies. There are a number of financial assistance programs available to San Diego County agencies: the Authority's Financial Assistance Program (FAP) and Reclaimed Water Development Fund (RWDF); the Metropolitan Water District of Southern California's Local Resources Program (LRP); the U.S. Bureau of Reclamation's Title XVI Grant Program; and the State Water Resources Control Board's low-interest loan programs. Together, these programs offer funding assistance for all project phases, from initial planning and design to construction and operation. Examples of how these funds facilitate water reuse projects in San Diego are described below:

- FAP provides loans to Authority member agencies for water reuse facilities planning, feasibility investigations, preliminary engineering studies, and research projects related to water reuse and/or groundwater development. The Authority provides funding on a 50:50 cost sharing basis up to $50,000 for any given project activity.

- FAP funds are also available for research and development in the form of grants. In order to receive FAP funding for these types of studies, a local agency must have secured partial funding from at least one other source such as the American Water Works Association Research Foundation (AWWARF), Desalination Research and Innovation Partnership (DRIP), Water Environmental Research Foundation (WERF), Proposition 13, etc.

- RWDF provides Authority member agencies financial assistance up to $100 per acre-foot ($0.31 per 1,000 gallons) for the development of reclaimed water projects capable of relieving a demand on the Authority. Project expenses must exceed project revenues. Funding is available for up to 25 years based on financial need.

- LRP is designed to ensure the financial feasibility of local projects during the initial years of operation. The Metropolitan Water District of Southern California offers an incentive of up to $250 per acre-foot ($0.77 per 1,000 gallons) for up to 25 years for reclaimed water and groundwater development projects that offset demands for imported water.

6.7.3 Grant Funding Through the Southwest Florida Water Management District

The Southwest Florida Water Management District (SWFWMD) is 1 of 5 water management districts in Florida with responsibilities for: water quality, natural systems improvement, flood protection, and water supply in a 10,000-square-mile (25,900-km^2) area. The SWFWMD is unique among the water management districts in Florida in that, beyond the similar structure of the governing boards, it has 9 basins with jurisdictional boundaries encompassing the major watersheds making up the District. In 8 of the 9 basins, populations have increased such that boards have been appointed to react to local, sub-regional water resource issues. These boards sponsor projects in coordination with local governments, private citizens, and private businesses, to improve, protect, and restore the water resources of their respective areas. These basin boards, like the Governing Board, have the authority to levy *ad valorem* taxes up to 0.5 of a mil within their boundaries.

The SWFWMD basin boards have provided local funds for local water resource-related projects since the District's creation in 1961. Originally, the focus of the basin boards and the Governing Board was on funding flood control projects. In the late 1980s, the basin priorities began to shift to the identification and funding of projects that focus on water conservation and the development of alternative water sources.

Recognizing the importance of their ability to support local governments by providing solutions to the growing issues surrounding water supply, the basins adopted a more proactive role in addressing local non-regulatory water issues. The Cooperative Funding Initiative, New Water Sources Initiative, and Water Supply and Resource Development funding was established in recognition of the growing need for a structured approach to projects in order to maximize the SWFWMD's effectiveness in choosing and funding water resource projects and budgeting for their completion.

The SWFWMD funds up to 50 percent of a project's capital cost and over the past 15 years has budgeted more than $182,000,000 in financial contributions towards reclaimed water development. As a result of Governing Board and basin board participation, more than 214 reuse projects totaling $494,000,000 in capital costs have been funded since Fiscal Year 1987.

Source: SWFWMD, 2003.

6.7.4 Use of Reclaimed Water to Augment Potable Supplies: An Economic Perspective (California)

To accurately assess the cost-effectiveness of any reuse project, including an indirect potable water reuse project, all potential benefits of the project must be considered. The beneficial effects of an indirect potable reuse project often extend beyond the sponsoring agency, providing regional benefits and, in many cases, benefits that extend statewide and beyond. In certain settings, indirect potable reuse projects may provide for large-scale beneficial use of reclaimed water with relatively modest additional infrastructure requirements. Examples of 2 such indirect potable reuse projects are underway in California: the East Valley Water Recycling Project (EVWRP), and the Orange County Groundwater Replenishment (GWR) System.

East Valley Water Recycling Project

Phase IA of the EVWRP includes approximately 10 miles (16 km) of 54-inch (137-cm) diameter pipeline and a pumping station to deliver tertiary treated reclaimed water from the Donald C. Tillman Water Reclamation Plant to the Hansen Spreading Grounds. Phase IA also includes an extensive monitoring well network designed to track the reclaimed water as it travels through the San Fernando Groundwater Basin from the spreading grounds to domestic production wells. This project will initially deliver up to 10,000 acre-feet per year (6,200 gpm) to the Hansen Spreading Grounds. Phase IB of the EVWRP will include construction of an additional pipeline to deliver reclaimed water to the Pacoima Spreading Grounds.

The cost of Phase IA is estimated at approximately $52 million. Up to 25 percent of this cost is being funded by the federal government through the Federal Reclamation Projects Authorization and Adjustment Act of 1992. Up to 50 percent of the total cost is being funded by the State of California through the Environmental Water Act of 1989. The remaining 25 percent of the total cost is being funded by ratepayers through special conservation and reclamation rate adjustments. **Table 6-4** provides calculations, in cost per acre-foot, for reclaimed water with and without federal and state requirements.

Based on these funding reimbursement percentages, Phase IA of the EVWRP will provide water at an estimated cost of $478 per acre-foot ($1.47 per 1,000 gallons), with a net cost of approximately $194 per acre-foot ($0.60 per 1,000 gallons) when state and federal funding is considered. Even if state or federal funding had not been available, the EVWRP would still provide a new reliable source of water at a cost comparable to other water supplies, and significantly less expensive than other new supply options. (According to the City Of Los Angeles Department of Water and Power Urban Water Management Plan Fiscal Year 1997-1998 Annual Update, seawater might be desalinated using new technology, which has produced desalted ocean water at a cost of about $800 per acre-foot ($2.35 per 1,000 gallons) in pilot tests, or approximately $2,000 per acre-foot ($6.14 per 1,000 gallons) using current technology.) Furthermore, the EVWRP has other benefits, which have not been quantified, such as the reduction of water imported from the Mono Basin and improved water system reliability resulting from a new local supply of water.

Orange County Groundwater Replenishment (GWR) System

Under the Orange County GWR System, highly treated reclaimed water will be pumped to either existing spreading basins, where it will percolate into and replenish the groundwater supply, or to a series of injection wells that act as a seawater intrusion control barrier. The GWR System will be implemented in 3 phases, providing a peak daily production capacity of 78,400 acre-feet per year (70 mgd) by the year 2007, 112,000 acre-feet per year (100 mgd) by 2013, and 145,600 acre-feet per year (130 mgd) by 2020.

Table 6-5 shows a conservative preliminary estimate of the capital and OM&R costs for Phase I of the GWR System based on December 2003 estimates.

The expected project benefits and their economic values (avoided costs) include:

Table 6-4. Estimated Capital and Maintenance Costs for Phase IVA With and Without Federal and State Reimbursements

	Without Federal and State Reimbursement	With 25% Federal and 50% State Reimbursement
Capital Costs	$52,000,000	$52,000,000
State Reimbursement (50%)	-0-	$26,000,000
Federal Reimbursement (25%)	-0-	$13,000,000
Net DWP Capital Expenditure	$52,000,000	$13,000,000
Amortized Net Capital Expenditure (6% interest for 30 years)	$3,777,743	$944,436
Operation & Maintenance Cost per Acre-foot (AF)	$100	$100
Annual Delivery	10,000 AF	10,000 AF
Cost of Delivered Water	$478 per acre-foot ($1.47 per 1,000 gal)	$194 per acre-foot ($0.60 per 1,000 gal)

1. Alternative Water Supply – If the GWR System is not implemented, Water Factory 21 would have to be rehabilitated at a construction cost of approximately $100 million to provide the water needed for seawater intrusion control via groundwater injection. Additional imported water at a yearly cost of approximately $4 million to $10 million would have to be purchased for use at the spreading basins as recharge water. In times of drought, there is also a penalty imposed on using imported water supplies, ranging from $175 to $250 per acre-foot, potentially adding fees up to $10.7 million a year. By implementing the GWR System, approximately $27.4 million in annual costs are avoided.

2. Salinity Management – The OCWD uses water from the Santa Ana River (consisting of upstream treated wastewater discharges and stormwater) and imported water (from the Colorado River Aqueduct and the State Water Project) to percolate into the forebay area of the Orange County groundwater basin. The treated wastewater discharges and water from the Colorado River are high in TDS, with concentrations over 700 mg/l. Higher TDS water can cause corrosion of plumbing fixtures and water heaters. Normalized costs for more frequent replacement of plumbing and water using fixtures and appliances are estimated to range from $100 to $150 per household each year. Over time, the reverse osmosis-treated product from the GWR System will lower the overall TDS content of the groundwater basin, saving the average household approximately $12.50 per year (or $25/acre-foot, $0.08 per 1,000 gallons). Industries and other large water users might also realize significant savings. From the standpoint of salinity management, the GWR System provides an annual benefit of $16.9 million.

3. Delay/Avoid Ocean Outfall Construction – Implementation of the GWR System will divert up to 100 mgd

Table 6-5. Cost Estimate for Phase I of the GWR System

Item	Cost
Capital Costs	$453.9 Million
Operation & Maintenance	$26.7 Million/year
Grant Receipts	$89.8 Million
Interest	2.6% amortized over 25 years
Power Cost	$0.11per kwh
Capacity Utilization	50% Barrier injection 50% Recharge percolation

(4,380 l/s) of peak wastewater flow during Phase I from the Sanitation District's ocean outfall disposal system. The estimated $175 million cost of a new ocean outfall can be delayed at least 10 years by applying several peak reduction methods, including diverting water to the GWR system instead of discharging to the ocean outfall.

Economic Summary

The annual cost to implement the GWR System – including capital, OM&R, engineering, administration, and contingencies, at 2.6 percent interest and amortized over a 25-year period – would be approximately $37.1 million. Totaling the avoided costs, the total annual benefits are as shown in **Table 6-6**.

This results in a maximum benefit-to-cost ratio of 1.33 ($49.2/$37.1). Based on this analysis, Orange County Water District and Orange County Sanitation District have decided to move forward with the implementation of this project.

The EVWRP and the GWR System exemplify how indirect potable reuse projects, when compared to other water supply and wastewater management options, can offer the greatest benefits for the least cost. The ultimate success of these projects would be attributable to project sponsors reaching out and forming alliances with the full array of beneficiaries.

The EVWRP and the GWR System exemplify how indirect potable reuse projects, when compared to other water supply and wastewater management options, can offer the greatest benefits for the least cost. The ultimate success of these projects would be attributable to project sponsors reaching out and forming alliances with the full array of beneficiaries.

Source: WateReuse Association, 1999. Updated by CDM/OCWD Project Team, 2004.

6.7.5 Impact Fee Development Considerations for Reclaimed Water Projects: Hillsborough County, Florida

Hillsborough County is located on the central-west coast of the State of Florida. The unincorporated area encompasses 931 square miles (2,411 km^2), or more than 86 percent of the total county area. Approximately 650,000 residents live in unincorporated Hillsborough County, and most of them are served by various community services provided by the County. The Hillsborough County Water Department is responsible for providing treatment and delivery of potable water, wastewater collection, and treatment and distribution of reclaimed water within unincorporated Hillsborough County. The Department currently saves about 10 mgd (440 l/s) of potable water through reuse. Future expansion of the reclaimed water system is expected to save about 30 mgd (1,315 l/s) of potable water by the year 2020.

Florida continues to be a rapidly growing state. To address the need for additional infrastructure, local governments have turned to development impact fees. Development impact fees are charges applied to new development to pay for the construction of new facilities or for the expansion of existing ones to meet these demands. Water and wastewater utilities are no exception. At least half of Florida's 67 counties use some form of impact fees to pay for expansion of their water and wastewater utility that is necessitated by growth in the community.

The following 3 criteria must be met to justify these fees: (1) there must be a reasonable connection between growth from new development and the resultant need for the

Table 6-6. Total Annual Benefits

Item	Total Annual Cost Avoidance (Millions $)
Orange County Water District (OWCD) Cost Avoidance	$27.40
Salinity Management	$16.90
Orange County Sanitation District (OCSD), Delay in outfall	$4.90
Total Benefits	$49.20

new service; (2) the fees charged cannot exceed a proportionate share of the cost incurred in accommodating the new users paying the fee; and (3) there must be a reasonable connection between the expenditure of the fees that are collected and the benefits received by the new customers paying the fees.

Several years ago, Hillsborough County decided to fund a portion of the cost of new reclaimed water projects through the capacity fee mechanism. It was recognized that the service benefits reclaimed water customers as well as new customers to the system that do not necessarily receive the reclaimed service. Specifically, reclaimed water projects have the unique characteristic of providing capacity in both the water and wastewater components of a traditional utility.

The Department's potable water investment since 1986, when the majority of the debt for the existing system was issued, is approximately $175 million with a corresponding potable water capacity of 54.5 mgd (2,400 l/s). The level of service prior to potable water conservation benefits derived from using reclaimed water was approximately 350 gpd (1,325 l/d) per Equivalent Residential Connection (ERC). Based on this level of service, the 54.5 mgd (2,400 l/s) potable water capacity would serve 155,714 ERCs. However, since reclaimed water service has been implemented, the Department has been able to reduce the level of service to 300 gpd (1,135 l/d) per ERC. The same 54.5 mgd (2,400 l/s) of capacity is now able to serve 181,667 ERCs with no additional investment in potable water capacity. This equates to 25,953 additional ERCs being served due to reclaimed water use – or a potable water capacity avoidance at the 350-gpd (1,325 l/d) level of service of 9.1 mgd (400 l/s). Assuming a cost of $5.25 per gpd for additional potable water capacity based on desalination treatment, the potable water capacity cost avoided is approximately $47.78 million.

The Department has 8 wastewater treatment plants with a total permitted treatment capacity of 48.5 mgd (2,125 l/s). These treatment plants have permitted effluent disposal capacity in the form of a surface-water discharge for 24 mgd (1,050 l/s). The difference of 24.5 mgd (1,075 l/s) is the effluent disposal benefit obtained from reclaimed water. Using a cost of $2.40 per gpd for either land application or deep-well injection methods for alternate effluent disposal, this results in an effluent disposal cost avoided of approximately $58.8 million.

Using these calculations, the total cost avoided for both water and wastewater is $106.58 million. The potable water capacity cost avoided and the effluent disposal cost avoided were each divided by this total cost to determine the allocation of reclaimed water project costs associated with water and wastewater. This resulted in a reclaimed water project cost split of 45 percent to water and 55 percent to wastewater.

The current North service area capacity fee is $1,335 for water and $1,815 for wastewater. For the South/Central service area, the current capacity fee is $1,440 for water and $1,970 for wastewater. **Table 6-7** provides the percentage of the capacity fees that have been attributed to reclaimed water projects in these service areas.

6.7.6 How Much Does it Cost and Who Pays: A Look at Florida's Reclaimed Water Rates

Reclaimed water is becoming an increasingly valuable water resource in Florida in terms of groundwater recharge, conservation of potable quality water, and drinking water cost savings to the consumer (since reclaimed water is usually less expensive than drinking water to the consumer). In fact, reuse has become so popular that some utilities have had trouble keeping up with the demand.

In order to meet the high demand for reclaimed water, some utilities have used other sources (i.e., groundwater, surface water, etc.) to augment their reclaimed water supply. Others deal with high reclaimed water demand by imposing watering restrictions on reuse customers, and/or limiting or prohibiting new customer connections to the reuse system. Many reclaimed water suppliers used these methods to try to meet demands when the

Table 6-7. Reclaimed Water Impact Fees

Service Area	Percent of Water Capacity Fee Allocated to Reclaimed Water	Percent of Wastewater Fee Allocated to Reclaimed Water
North	8	29
South/Central	6	18

state was faced with a drought, but a few suppliers still struggled. The need to conserve and properly manage reclaimed water as a valuable resource became very clear.

In the past, many utilities provided reclaimed water at no cost to the customer or based on a fixed monthly charge, regardless of use. Since the water was free or sold at low flat rates, customers used as much as they wanted, which was usually more than they needed. Now, many utilities are moving towards volume-based charges for reclaimed water service. Although the main intent of charging reuse customers for reclaimed water is to recover the costs associated with reuse facilities, reuse customers that are charged by the gallon for reclaimed water service tend to be more conservative in their use of the water supply.

1999 Florida Reclaimed Water Rates

Every year, the Florida Department of Environmental Protection publishes the *Reuse Inventory* that contains a good deal of useful information regarding water reclamation facilities in Florida, including reuse rates charged by facilities. The *1999 Reuse Inventory* (FDEP, 2000) compiles rates under 2 categories, Residential and Non-Residential. A survey based on information from the *1999 Reuse Inventory* for 176 reuse systems revealed the following:

Non-Residential Category: Forty-five percent of the reuse systems provided reclaimed water free of charge, 33 percent charged by the gallon, about 10 percent charged a flat rate, and 12 percent incorporated the base facility charge and the gallonage charge.

Residential Category: Eight percent of the systems surveyed provided reclaimed water free of charge, 12 percent by the gallon, 22 percent charged a flat rate, and about 10 percent utilized the base facility charge and the gallonage charge. (48 percent of the systems surveyed did not provide residential service.) The average rates associated with each rate type are shown in **Table 6-8**.

According to an AWWA survey, reuse rates are developed in many different ways. Out of 99 facilities surveyed, 19 percent set the rate at a percentage of the potable water rate, 14 percent base the rate on the estimated cost of the reuse service, 24 percent set the rate to promote use, 9 percent base the rate on market analysis, and 33 percent use other methods to develop reuse rates. The survey also revealed what percentages of costs were recovered through reuse rates for these facilities as shown in **Table 6-9**.

Fifty-three percent of 97 facilities surveyed charge a uniform rate for reclaimed water, approximately 6 percent charge inclining block rates, 2 percent charge declining block rates, and 6 percent charge seasonal rates. The other 33 percent used some other type of rate structure (AWWA, 2000). The survey shows that the majority of reuse customers are metered. The average metered rate of 16 surveyed facilities was $1.12/1,000 gallons.

In order to determine the relationship between how much reclaimed water a reuse customer used and how much they were charged for the service, the Southwest Florida Water Management District (SWFWMD) conducted a survey of utilities in Pinellas County that provided reclaimed water to residential customers. This survey revealed that residential customers who were charged a flat rate used an average of 1,112 gallons of reclaimed water per day, while residential customers who were charged per 1,000 gallons only used an average of 579 gallons per day (Andrade, 2000). The average metered rate charged by these utilities was $0.61/1000 gallons. The average flat rate charged by these utilities was $9.77/month. Based on the average usage of 1,112 gallons per day reported for residential customers, this flat rate translates to a metered rate of $0.29/1000 gallons.

Source: Coleman and Andrade, 2001

Table 6-8. Average Rates for Reclaimed Water Service in Florida

	Non-Residential	Residential
Flat Rate 1*	$19.39/month	$6.85/month
Flat Rate 2**	$892,89/month	Not Applicable
Metered Rate	$0.26/1,000 gallons	$0.39/1,000 gallons
Flat Rate with Metered Rate	$29.99/month+$0.39/1,000 gallons	$7.05/month+$0.34/1,000 gallons

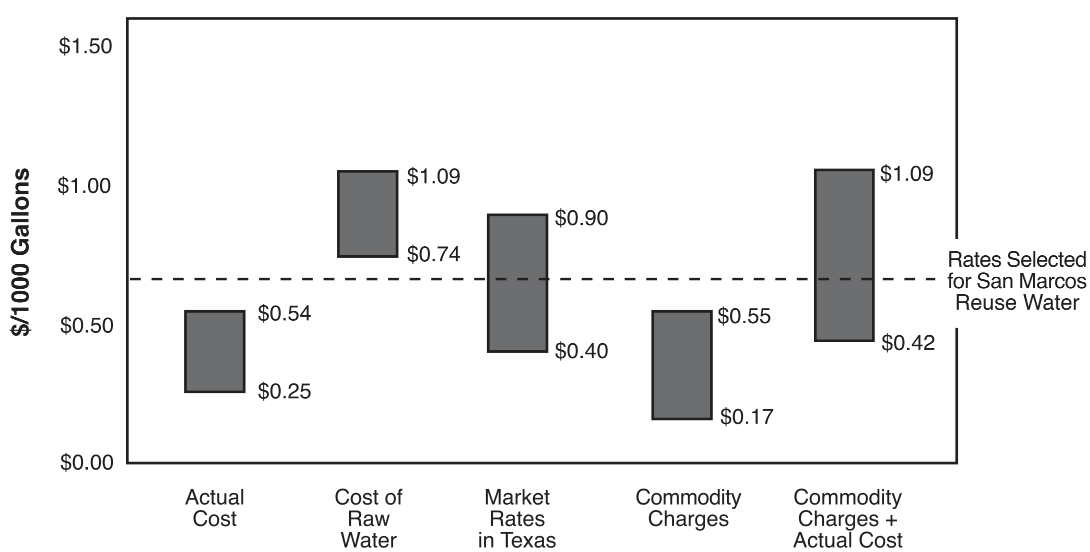
Table 6-9. Percent Costs Recovered Through Reuse Rates

Percent of Costs Recovered	Percent of Utilities Recovering Costs
Under 25 Percent	32
25 to 50 Percent	5
51 to 75 Percent	5
76 to 99 Percent	14
100 Percent	13
Unknown	31

6.7.7 Rate Setting for Industrial Reuse in San Marcos, Texas

The newly expanded San Marcos 9-mgd (395-l/s) advanced tertiary wastewater treatment plant is a state-of-the-art facility that produces some of the highest quality effluent in the State of Texas. The permit requirements are the toughest the Texas Natural Resources Conservation Commission deploys: 5/5/2/1/6 (BOD_5/TSS/NH_3/PO_4/DO). Since coming on-line last year, the quality of the effluent has consistently been better than the permit limits require. In this region of the state, the use of groundwater is discouraged and surface water is becoming less available and more costly; therefore, reclaimed water is becoming a marketable commodity. In January 1999, American National Power approached the City of San Marcos, as well as other cities in the Central Texas area between Austin and San Antonio, with a list of resources required for the power co-generation facility they were to build – *The Hays Energy Project (HEP)* – in anticipation of the imminent electrical power deregulation in Texas. Principal on the list was a reliable, economical source of both potable and process water, and a means of disposing of their domestic wastewater and process wastewater. The City had no existing wastewater treatment plant effluent customers and no historical basis for setting a rate to charge the HEP for delivering to them basically the City's entire effluent flow.

Figure 6-2. Comparison of Rate Basis for San Marcos Reuse Water



In considering rates to this industrial customer, the City of San Marcos investigated both the actual cost of producing and delivering reclaimed water as well as the market value of reclaimed water. By including only those facilities over and above what was required for normal wastewater treatment and disposal, the actual cost of delivering reclaimed water was determined to be between \$0.25 to \$0.54/1,000 gallons. A review of the existing costs of alternate suppliers of water in the region was then conducted to define the market value of reclaimed water to the industrial customers. This investigation included reuse rates charged elsewhere in the state and determined that the cost of alternate water supplies might range from \$0.40 to \$0.90/1,000 gallons. The results of this investigation are summarized in **Figure 6-2**.

Based on the results of this investigation, the City was able to consider reclaimed water as a commodity and set the charges as a function of available supplies, the demand for water and the benefits of the service. Through this process, the City established a charge of \$0.69/1,000 gallon as shown in Figure 6-2.

Source: Longoria *et al.,* 2000.

6.8 References

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